Transient Performance Evaluation and Control Measures for Oum Azza Pumping Station Case Study

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Abstract : This work presents a case study of water-hammer analysis and control for the Oum Azza pumping station project in the coastal area of Rabat to Casablanca from the dam Sidi Mohamed Ben Abdellah (SMBA). This is a typical pumping system with a long penstock and is currently at design and executions stages. Since there is no ideal location for construction of protection devices, the protection devices were provisionally designed to protect the whole conveying pipeline. The simulation results for the transient conditions caused by a sudden pumping stopping without including any protection devices, show that there is a negative beyond 1300m to the station 5725m near the arrival of the reservoir, therefore; there is a need for the protection devices to protect the conveying pipeline. To achieve the goal behind the transient flow analysis which is to protect the conveying pipeline system, four scenarios had been investigated in this case study with two types of protecting devices (pressure relief valve and desurging tank with automatic air control). The four scenarios are conceders as with pressure relief valve, with pressure relief valve and a desurging tank with automatic air control, with pressure relief valve and tow desurging tanks with automatic air control and with pressure relief valve and three desurging tanks with automatic air control. The simulation result for the first scenario shows that overpressure corresponding to an instant pumping stopping is reduced from 263m to 240m, and the minimum hydraulic grad line for the length approximately from station 1300m to station 5725m is still below the pipeline profile which means that the pipe must be equipped with another a protective devices for smoothing depressions. The simulation results for the second scenario show that the minimum and maximum pressures envelopes are decreases especially in the depression phase but not effectively protects the conduct in this case study. The minimum pressure increased from -77.7m for the previous scenario to -65.9m for the current scenario. Therefore the pipeline is still requiring additional protective devices; another desurging tank with automatic air control is installed at station2575.84m. The simulation results for the third scenario show that the minimum and maximum pressures envelopes are decreases but not effectively protects the conduct in this case study since the depression is still exist and varies from -0.6m to– 12m. Therefore the pipeline is still requiring additional protective devices; another desurging tank with automatic air control is installed at station 5670.32 m. Examination of the envelope curves of the minimum pressuresresults for the fourth scenario, we noticed that the piezometric pressure along the pipe remains positive over the entire length of the pipe. We can, therefore, conclude that such scenario can provide effective protection for the pipeline.
Keywords : analysis methods, protection devices, transient flow, water hammer
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